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Memorandum

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TO : Superintendent Assateague

DATE: March 2, 1972

FROM : J. Robert Stottlemyer, NPS - EROS Coordinator

SUBJECT: Application of Remote Sensing to Barrier Island Research

Attached is the interim report of ecological projects underway on national seashores using aerial remote sensing as a research device.

Enclosure

5010-103

The Commonwealth of Massachusetts
University of Massachusetts
Amherst 01002

November 5, 1971

Memo to: Chief Scientist, Office of Natural Science Studies, National Park Service

From : Paul Godfrey, Department of Botany, University of Massachusetts

Subject: Interim Report on my Projects Involving the use of Remote Sensing for Ecological Research on Eastern National Seashores.

The feasibility of remote sensing techniques for ecological investigations in coastal areas has been shown by several NASA sponsored projects during recent years. Much, however, is still experimental in the field of obtaining ecologically useful information from such imagery. The N.P.S. is using both low and high altitude photography, particularly color infra-red to map and monitor ecological changes in eastern seashores. Our primary study area consists of the Cape Lookout and Cape Hatteras National Seashores, two adjacent seashores - one with a long history of development and manipulation, the other basically undeveloped and in a more or less natural condition.

Our first priority is to develop an accurate vegetation map of the seashores and to determine the total area of each community type for future comparisons. We have already begun the mapping with existing black and white photographs dating back to the 1930's.

Underwater vegetation has shown dramatic changes over a period of a few years. Such changes were noticed by Dan Stetka, a graduate student in marine science at U-Mass working on the interpretation of aerial photographs at the CLNS. These fluctuations could not have been determined without the aerial photos. Mr. Stetka is attempting to correlate infra-red imagery with standing crop and species composition of underwater vegetation in and bordering the Cape Lookout National Seashore. A detailed report of his findings to date is now being completed and will be forwarded to your office within the next two weeks.

Quantitative transects using the parameter of percent cover and biomass have been made across the terrestrial portion of the CLNS study areas (Codd's Creek) and such data will be correlated with the images on black and white photographs plus a recently flown low altitude infra-red mission.

We have found that for most purposes, especially mapping underwater vegetation, high altitude RB-57 infra-red photographs taken at 60,000 ~~and 120,000~~ feet can be used readily following enlargement. These photographs are nearly as useful as the low altitude black and white photographs (taken at 9100') that we have been using. The use of high resolution, high altitude photographs greatly simplifies general vegetation mapping, and will cut mission costs since one shot can cover 10 miles or more. We could readily differentiate between underwater vegetation, bare bottom, shoals, salt marshes, woodlands, thickets, grasslands, dune areas and the bare beach.

It also appears that water depth in the sounds can be roughly determined. Further study of the photographs we now have should reveal more information. A series of high altitude photographs taken on a regular schedule at different times of the year should provide an excellent means of charting changes with the seasons and years.

While very useful for many purposes, we cannot get away completely from low altitude photography especially when detailed mapping of terrestrial vegetation is desired. The extensive grasslands and marshes of the National Seashores have many community types within one broad class of vegetation. Such types can only be accurately distinguished by low altitude imagery.

We hope to follow the ecological changes that occur due to man's activity compared to those of nature. At the present time changes are becoming critical and we need to develop the ability to distinguish interactions with man-induced alteration and natural processes that may not be readily seen from the ground. Both natural and man-made changes occur at rapid rates in coastal areas and are frequently conflicting. The two adjacent seashores offer an excellent opportunity for such evaluations. The development of man-made stability on the CHNS has changed the normal pattern of plant succession by eliminating the major controlling feature of the natural environment mainly overwash and, to a lesser extent, salt spray. Such alterations are now causing management problems. On the CLNS, however, normal successionary sequences still occur and thus data from that area provides an excellent baseline for comparative evaluations.

The recent closure of an inlet (Drum) in the CLNS provides an excellent research topic. We have the chance to follow and carefully document succession on the shoals behind the old inlet. New salt marshes are now forming on these shoals. Such a pattern of development has never been quantitatively described and yet it has great implication for estuarine productivity and Seashore management. We have convincing evidence that many, if not all, of present day salt marsh islands behind the outer banks have developed on the shoals formed by old inlets. We can now follow this pattern with great accuracy during the coming years with remote sensing.

A man-made inlet is to be created near the closed natural inlet and we have another chance to follow the changes caused by this action. We may be able to detect the pattern of inlet shoaling and change from the air well before it appears on the ground and thus corrective actions might be instituted sooner. Further, we hope to determine the feasibility of using remote sensing to detect pollution input which could change and degrade natural ecosystems within the seashores. This is a particularly difficult problem, yet one of increasing concern, especially in those seashores near large urban centers. Unfortunately, many National Seashores are literally at the end of the sewer pipe.

Remote sensing of coastal areas will provide basic ecological data on the changes of substrate-shoals, silting, and so forth - that affect underwater vegetation. Little is known about the physical factors which control the marine grassbeds behind the outer banks.

Photography will provide an indispensible technique for spotting such changes. We have already noticed physical features of the bay bottom which affect the distribution of the vegetation in ways we do not yet understand. The management of the seashores and associated estuaries should take such changes into account and we will need to evaluate whether they are normal or man-induced. It is essential to know how much alteration and of what type can be tolerated by the estuarine ecosystem.

Increasing public use of National Seashores and associated waterways demands that we carefully watch the natural pattern for detrimental changes due to such activity and institute control measures before lasting damage results. As any natural scientist who has flown over the coastal areas knows, the only way to really see the area and what is going on is from the air!

Summary of our N.P.S. ecological projects using (or in planning) remote sensing on the National Seashores.

1. a. Vegetation mapping and historical changes of vegetation on the Cape Lookout National Seashore including terrestrial and underwater communities. Creating baseline information to be used in evaluating future changes as well as using existing photographs to determine what changes have already occured. With Melinda Godfrey and Dan Stetka graduate student at U-Mass. in Marine Science (working on a Master's degree).

b. A similar project can be done for Cape Hatteras N.S. when time permits. Newly flown imagery will be used to map the vegetation of CHNS.

2. A comparison of successional changes of ecosystems between Cape Hatteras and Cape Lookout National Seashores with Dr. William Odum, University of Virginia.

3. Dune stabilization study of National Seashores with Dr. Robert Dolan, University of Virginia.

4. Evaluation of salt marsh status on Fire Island National Seashore. This study is aimed at describing the alteration of salt marshes by mosquito ditching and to determine whether man-made or natural causes have led to the apparent degradation of some marsh lands. Aerial photographs both, historical and recent, will be indispensible in determining how the marshes have changed.

With Joseph Dowhan - graduate student (Ph.D. degree), Department of Botany, U-Mass.

5. An ecological study now being done on Pilgrim Lake, Cape Cod National Seashore, might use infra-red photography to spot sources of pollution running into the lake and leading to excessive eutrophication and attendant problems. Algal blooms have been identified in IR photos elsewhere and linked to possible nutrient enrichment by pollution.

Such a technique might be used at Pilgrim Lake.

With Walter Mozgala - graduate student (Master's Degree), Department of Botany, U-Mass.

Copies to:
Supt., Cape Cod N.S.
Supt., Fire Island N.S.
Supt., Assateague Island N.S.
Supt., Cape Hatteras N.S.
Supt., Cape Lookout N.S.
Supt., Padre Island N.S.